

Requested Patent: GB2378629A  
Title: LINEAR PROGRESS BAR GRAPH ;  
Abstracted Patent: GB2378629 ;  
Publication Date: 2003-02-12 ;  
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Applicant(s): PACE MICRO TECH PLC (GB) ;  
Application Number: GB20020014238 20020620 ;  
Priority Number(s): GB20010015415 20010623 ;  
IPC Classification: G06T11/20 ;  
Equivalents: ;

**ABSTRACT:**

A display represents the performance of a function of an apparatus, with 0% completion of the function being represented at a first end and 100% completion of the function being represented at a second end of the display. The display is provided with indication means to indicate progress of the function in time to completion. The function is divided into a number of sub-functions, each sub-function being allocated a portion of the display. Each portion of the display represents the completion of the sub-function between 0% and 100%, with the size of the portion of the display defined as the time estimated to be required for completion of the sub-function with respect to the total time required for completion of the whole function.

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# (12) UK Patent Application (19) GB (11) 2 378 629 (13) A

(43) Date of A Publication 12.02.2003

(21) Application No 0214238.8

(22) Date of Filing 20.06.2002

(30) Priority Data

(31) 0115415 (32) 23.06.2001 (33) GB

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(51) INT CL<sup>7</sup>

G06T 11/20

(52) UK CL (Edition V)

H4T TBAX T120

(56) Documents Cited

EP 0394160 A2

(58) Field of Search

UK CL (Edition T) H4T

INT CL<sup>7</sup> G06T, G09G

Other: ONLINE: WPI EPODOC PAJ INTERNET

(54) Abstract Title

Linear progress bar graph

(57) A display represents the performance of a function of an apparatus, with 0% completion of the function being represented at a first end and 100% completion of the function being represented at a second end of the display. The display is provided with indication means to indicate progress of the function in time to completion. The function is divided into a number of sub-functions, each sub-function being allocated a portion of the display. Each portion of the display represents the completion of the sub-function between 0% and 100%, with the size of the portion of the display defined as the time estimated to be required for completion of the sub-function with respect to the total time required for completion of the whole function.

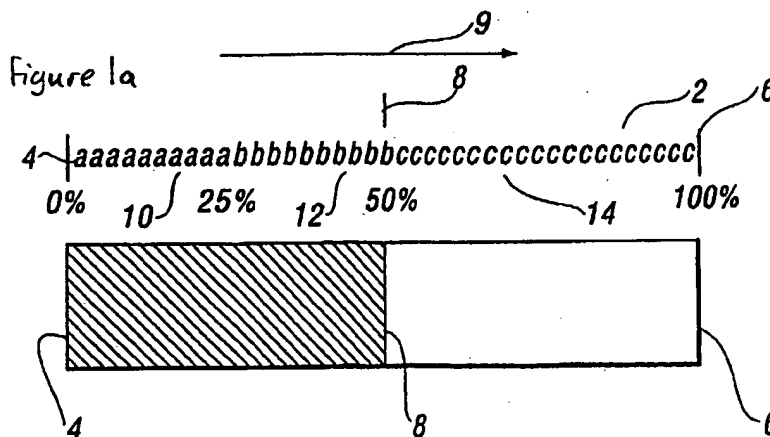


FIG. 1B

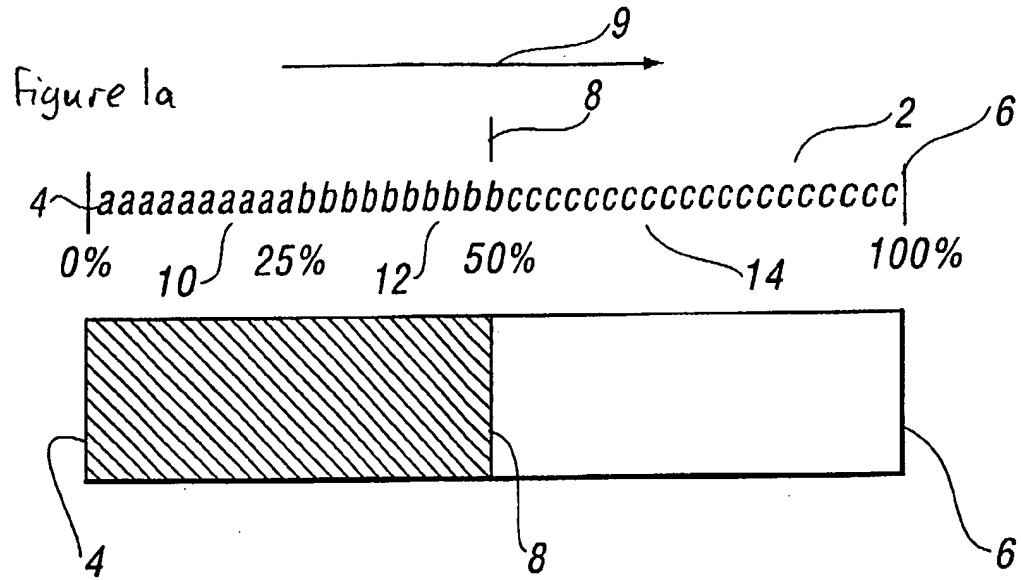


FIG. 1B

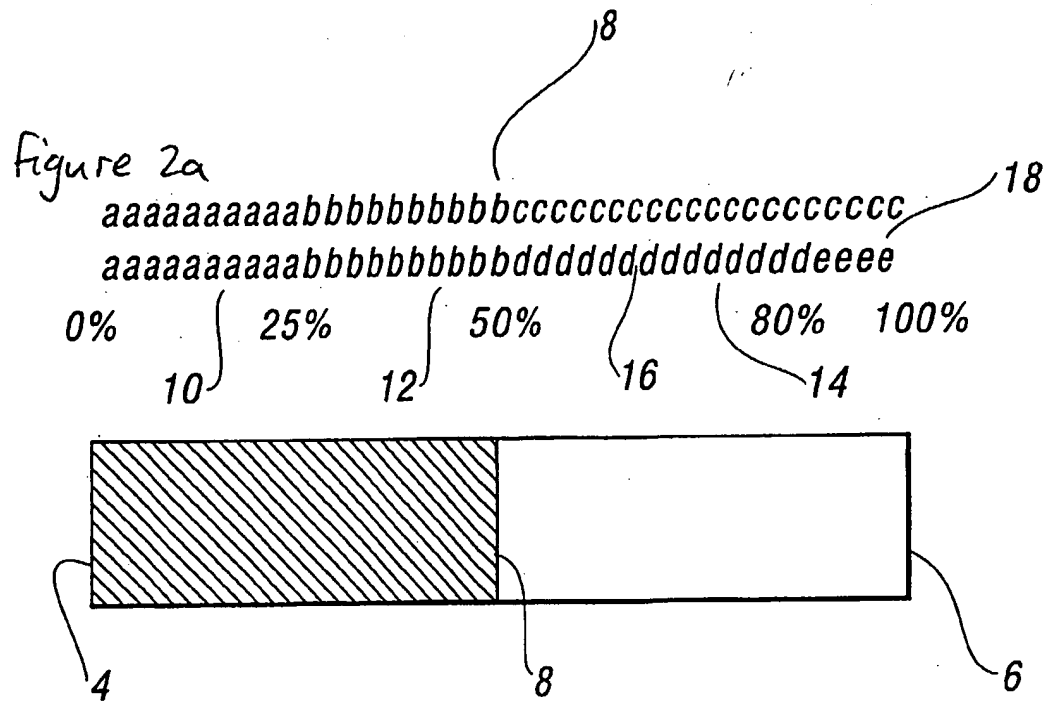


FIG. 2B

## Linear Progress Bar Graph and Method Thereof

The invention which is the subject of this application is a display for electrical apparatus on a display screen which indicates the passage of time and the time to completion of a particular function of the apparatus and a method for the generation of the display.

The use of display screens in or forming part of electrical apparatus, such as computers, broadcast data receivers and the like, are increasingly being used to inform a user as to the progress or performance of particular selected functions of the apparatus or processing means of the apparatus. For example, if data is being downloaded to electrical apparatus, the apparatus can appear to a user to have stopped operating during the time of the download. This may cause the user to unnecessarily switch the apparatus on/off or repeatedly press control keys/buttons. A moving indicator is therefore provided on the display screen to inform a user that the apparatus is in the process of performing a data download function and has not stopped functioning.

A conventional method of illustrating the performance of a particular function in electrical apparatus is to generate a graphical linear bar display on the display screen of the apparatus. This display typically comprises a linear box with the start, typically the left hand side of the box, representing 0% completion of a particular function, and the other end, typically the right hand side of the box representing 100% or completion of the particular function. A change in colour of the box is typically generated progressively from the 0 to 100% end of the box to indicate the progression of the function to completion. An interface is formed between two different colours provided

in the linear box and the movement of the colour interface across the box is believed by most users to illustrate the particular percentage of completion of the function.

In practise, the linear progression of the colour interface across the graphic display bar from one end to another end does not provide a true indication of the time remaining before the function is complete. For example, many graphical displays cause the colour interface to initially move relatively quickly from zero to an intermediate percentage on the bar. The colour interface thereafter moves relatively slowly as it approaches 100% completion. This provides the user with a false estimation of the time still required for completion of the function and/or the time already elapsed to partially complete the function. Thus, at the present time, the graphical display is, at best, an estimate of the performance of the function rather than relating to any particular degree of accuracy of progress or performance of the function.

The aim of the present invention is to allow the generation of a graphical linear display of the type herein described but to generate the graphical display with reference to a more accurate time indication and, more importantly, the true time taken to perform the percentage of the function as the colour interface of the linear display moves.

In a first aspect of the invention there is provided a display for electrical apparatus, said display representative of the performance of a function of said apparatus and said display representing 0% completion of the function at a first end and 100% completion of the function at a second end of the display, said display provided with indication means to indicate progress in the time to completion and wherein the function is divided

into a number of sub-functions, each sub-function being allocated a portion of the display, with each portion of the display representing the completion of the sub-function between 0% and 100%, with the size of each portion of the display determined by comparison of the time estimated to be required for completion of the sub-function with respect to the total time required for completion of the function.

Typically, the movement of the indication means at any part in the linear display is at a speed which is representative of the performance (progress in time to completion of the function) of a particular sub-function between 0% and 100% of the completion of that sub-function. Thus the movement of the indication means at any part of the linear display for the whole function, is in fact determined by the performance of the sub-function which is appropriate for that portion in which the colour interface is located at that time.

Preferably the indication means is in the form of a colour interface between two or more different colours provided on the graphical linear display.

In one embodiment, each sub-function can be split into a further number of sub-functions as required, depending on the particular number of sub-functions which are required to be performed to complete the whole function.

Preferably the electrical apparatus is a broadcast data receiver.

According to a second aspect of the present invention there is provided a method of generating a display for electrical apparatus, said display representative of the performance of a function of said apparatus and said display representing 0%

completion of the function at a first end and 100% completion of the function at a second end of the display, said display provided with indication means to indicate progress of the function in time to completion, and wherein the method includes the steps of dividing the function into a number of sub-functions, allocating a portion of the display to each sub-function so that each portion of the display represents the completion of the sub-function between 0% and 100%, and making the size of the portion of the display representative of the time estimated to be required for completion of the sub-function with respect to the total time required for completion of the function.

The present invention therefore allows the progress of indication means, typically in the form of a colour interface, along the linear display in a smooth and linear manner against time, even if some of the sub-functions of the function take longer than others to perform.

Specific embodiments of the invention will now be described, with reference to the accompanying diagrams, wherein:-

Figure 1a illustrates the generation of a linear display in accordance with one embodiment of the invention;

Figure 1b illustrates the linear display as seen by a user on a display screen;

Figure 2a illustrates the generation of a second type of linear display in accordance with the second embodiment of the invention; and

Figure 2b illustrates the linear display as seen by a user on a display screen.

The linear display of Figure 1 has been generated on a display screen of electrical apparatus in response to a user requiring a particular function to be performed, in this case the loading of particular software onto a personal computer. The linear display 2 has a start position 4, which represents 0% completion of the function, and an end position 6, which represents 100% completion of the function. Indication means in the form of a colour interface (indicated by a broken line 8 which in this case shows the interface as being at 50%) is provided in the display 2 and moves progressively therealong to represent the particular location reached by the function at that time relative to the time for completion of the function, and the progression of the function through to completion. Thus the colour interface starts at 0% and moves across the display to reach 100% on completion of the total function, as illustrated by arrow 9. Figure 1b illustrates an example of the type of display generated by the method shown in figure 1a, as seen by the user on the display screen of the apparatus.

The function is broken down into a number of sub-functions 10, 12 and 14 indicated by the letters "a", "b" and "c". The relative durations to perform each sub-function are determined by actual measurement or are estimated using the best data available. This estimation can be undertaken at the time of generation of the software for the particular function or, if it is likely to depend on run-time conditions such as the particular parameters of a personal computer, then the estimation may be calculated at the time of generation of the linear display given the condition parameters at that time.

Once the estimates for the time taken to perform the whole function and sub-functions are complete, the estimated time for each sub-function is compared to the estimated time for completion of the whole function. With this comparison, a relative proportion of the linear display length is allocated to each sub-function. As each sub-function performs its task, the position of the indication means 8 is updated along the relevant portion of the linear display in a linear manner, corresponding to the progress to completion of the sub-function.

For example, with reference to Figure 1, a specific function display has been broken into three sub-functions, 10, 12, 14. The first sub-function and second sub-function 10, 12 are expected to take 10 seconds each with the first sub-function length being illustrated, in this case, by the letters "a" and the second sub-function length being illustrated by the letters "b". The time taken to perform each sub-function is reflected in terms of the portion of the linear display allocated to each sub-function. The length of the last sub-function 14 is indicated by the letters "c", and this sub-function is estimated to take 20 seconds to completion. As such, the portion of the display with the letters "c" is double that of the sub-functions represented by letters "a" and "b". Since the overall function will take 40 seconds to complete, i.e., from position 4 to position 6, the sub-function "c", expected to take 20secs has been allocated 50% of the display length to illustrate to the user its progress through to completion.

In practise, from commencement at position 4 as sub-function 10 progresses, the indication means moves from the 0% to the 25% indicator in a linear manner corresponding to the work done in that sub-function. When it is complete the interface 8 will be located at the 25% indication.

Sub-function 12 then commences and the interface moves from the position shown at 25% to the location shown at 50%, again in a linear manner. Finally, sub-function 14 is performed and the interface 8 moves from the location shown at 50% to the location shown at 100%, thereby illustrating the work done to complete the sub-function 14 and hence complete the total function to arrive at the 100% indicator. The speed at which the colour interface moves through each sub-function portion of the display represents the speed at which the sub-function is being performed at, thereby illustrating to a user at any particular point the work undertaken in relation to the sub-function so far and the work still to be undertaken until the sub-function reaches completion of its task, rather than the function as a whole which can conventionally result in a relatively non-linear movement of the indication means.

In another embodiment, the process can be extended so that, for example, with reference to Figure 2, sub-function 14 can be broken down into sub-tasks 16 and 18. The actual display bar as seen by a user of the apparatus remains the same as that of figure 1b, as shown in figure 2b, but the method in which the display bar is different in that the display is divided into sub-functions and sub-tasks. Sub-task 16 is indicated by the letters "d" and takes four times longer to complete than sub-task 18 indicated by the letters "e", and indicated in the bottom line of the linear display of Figure 3. In this case, sub-function 14 is responsible for updating the bar graph from 50% to 100% but the actual movement of the indicating means with respect to the speed at which the sub-tasks 16 and 18 are performed. The performance of the sub-task 16 updates the indication means 8 and results in movement of the same from the location at 50% to the location at 90%, while the performance of the sub-task 18

results in the movement of the interface from the location at 90% to the end of the bar display at 100%.

In a computer programme, this can be achieved by passing start and finish percentage indicators to each task/function routine so that the correct section of the display can be updated. Thus, in the above example in Figure 1, the following would be used:-

```
Void task(int start_percent, int finish_percent)

{
int task_duration, task_a_end, task_b_end, task_c_end;

task_duration=finish_percent-start_percent; task_a_end=start_percent+task_duration*
0.25; sub_task_a(start_percent, task_a_end); task_b_end=task_a_end+task_duration*
0.25; sub_task_b(task_a_end, task_b_end); task_c_end=task_b_end+task_duration*0.50;
sub_task_c(task_b_end, task_c_end);
}
```

Task\_a\_end represents sub function 10 and the point on the linear display (0 to 100%) where task\_a should finish. Each sub-task routine is provided with values representing the portion of the bar graph that should be updated as that task progresses. For example, task\_b performs the task of sub function 12 and also updates the bar graph from the point in the display where task\_a finished to the point where task\_b is to finish (i.e. 25% to 50%) and task\_c relates to subfunction 14.

In a further specific example, a memory such as a flash memory of a device is capable of being upgraded via a modem or Ethernet link. Upgrade data is known to take 9 minutes to download via a modem, or 1 minute to download via the Ethernet. In both cases it takes an additional minute to

programme the data into the memory. When downloading the data via a modem, the indicating means of the linear display progresses from 0% to 90% and the flash programming sub-function then advances the interface of the linear display from 90% to 100% to indicate the total completion of the function.

If the data is downloaded via the Ethernet, the indicating means of the linear display progresses from 0% to 50% as the first sub-function is completed and the flash programming sub-function then advances the interface of the linear display from 50% to 100% to indicate completion of the function.

In both cases the interface of the linear display moves linearly without stopping, jumping or changing speed.

Furthermore, if the flash programming sub-function is broken down into programming and verifying functions, then the movement of the interface of the linear display during the flash programming sub-function is shared between these two sub-functions according to the expected duration of each. The interface will still move in a linear manner along the linear display even though three different sub-functions are running at different speeds and taking different amounts of time, thereby providing a clearer and more accurate indication of the progression of time of the function and more importantly, a true indication of the time still required before completion of the function.

## Claims:-

1. A display for electrical apparatus, said display representative of the performance of a function of said apparatus and said display representing 0% completion of the function at a first end and 100% completion of the function at a second end of the display, said display provided with indication means to indicate progress of the time to completion, and wherein the function is divided into a number of sub-functions, each sub-function being allocated a portion of the display, with each portion of the display representing the completion of the respective sub-function between 0% and 100%, with the size of each portion of the display determined by comparison of the time estimated to be required for completion of the sub-function with respect to the total time required for completion of the function.
2. A display according to claim 1 wherein the indication means moves on the display at a speed which is representative of the progress in time to completion of a particular sub-function in which the indication means is located at that time.
3. A display according to claim 1 wherein each sub-function is split into a further number of sub-functions as required.
4. A display according to claim 1 wherein the display is a linear display.
5. A display according to claim 1 wherein the indication means is a colour interface on the display.

6. A method of generating a display for electrical apparatus, said display representative of the performance of a function of said apparatus and said display representing 0% completion of the function at a first end and 100% completion of the function at a second end of the display, said display provided with indication means to indicate progress of the function in time to completion, and wherein the method includes the steps of dividing the function into a number of sub-functions, allocating a portion of the display to each sub-function so that each portion of the display represents the completion of the sub-function between 0% and 100%, and making the size of the portion of the display representative of the time estimated to be required for completion of each sub-function with respect to the total time required for completion of the function.